

TGAL-89-01

**CENTER FOR SEISMIC STUDIES
FINAL REPORT
PHASE I**

P. Kovacs, R.L. Perez, W.W. Whyte

**Teledyne Geotech
314 Montgomery Street
Alexandria, Virginia 22314-1581**

**DTIC
ELECTE
MAR 31 1989
S D & D**

MARCH 1983

ARPA ORDER NO: 4198

**PROJECT TITLE: Installation, Maintenance, Operation, and Development
Support for a Prototype Seismic Data Center**

CONTRACT: MDA903-82-C-0063

AD-A206 310 Approved for Public Release; Distribution Unlimited.

**Prepared for:
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
1400 Wilson Boulevard
Arlington, VA 22209**

**Monitored by:
DEFENSE SUPPLY SERVICE-WASHINGTON
Room 1D245, Pentagon
Washington, D.C. 20310**

The views and conclusions contained in this report are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Defense Advanced Research Projects Agency or the U.S. Government.

89 3 21 068

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188 Exp. Date: Jun 30, 1986	
1a REPORT SECURITY CLASSIFICATION Unclassified			1b RESTRICTIVE MARKINGS		
2a SECURITY CLASSIFICATION AUTHORITY			3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for Public Release; Distribution Unlimited		
2b DECLASSIFICATION/DOWNGRADING SCHEDULE					
4 PERFORMING ORGANIZATION REPORT NUMBER(S) TGAL-89-01			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a NAME OF PERFORMING ORGANIZATION Teledyne Geotech Alexandria Laboratories		6b OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION Defense Supply Service - Washington		
6c. ADDRESS (City, State, and ZIP Code) 314 Montgomery Street Alexandria, VA 22314			7b. ADDRESS (City, State, and ZIP Code) Room 1D-245, The Pentagon Washington, D.C. 20310		
8a. NAME OF FUNDING /SPONSORING ORGANIZATION DARPA		8b OFFICE SYMBOL (If applicable) NMRO	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER MDA903-82-C-0063		
8c. ADDRESS (City, State, and ZIP Code) 1400 Wilson Boulevard Arlington, VA 22209			10. SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO.	PROJECT NO. 4198	TASK NO.
11. TITLE (Include Security Classification) Installation, Maintenance, Operation, and Development Support for a Prototype Seismic Data Center					
12. PERSONAL AUTHOR(S) P. Kovacs, R. Perez, W. Whyte					
13a. TYPE OF REPORT Final Technical Report		13b. TIME COVERED FROM Dec 81 to Feb 83		14. DATE OF REPORT (Year, Month, Day) 1989, March, 15	
15. PAGE COUNT 11					
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	Seismology RSTN Network Data Center VAX Computer		
19. ABSTRACT (Continue on reverse if necessary and identify by block number)					
<p>→ This report summarizes the work performed to establish a Center for Seismic Studies for the Defense Advanced Research Projects Agency (DARPA). It covers Phase I of a three-phase contract; the first phase was for the time period beginning December 1, 1981 through January 31, 1983. The objectives during this phase were to obtain a suitable facility, modify it to accommodate people, computers systems, magnetic tape storage, a film library, and to provide offices, conference rooms, a demonstration room, and technical libraries for visitors and staff. Secure areas were also needed for processing and storing classified data.</p> <p>The site selected for the Center was Rosslyn, Virginia, in close proximity to the headquarters of DARPA. Most of the computer equipment came from Lincoln Laboratories. It was shipped and installed in several stages throughout the contract in communication software, new hardware, and hardware from other sources. A satellite antenna was procured to</p>					
20 DISTRIBUTION/AVAILABILITY OF ABSTRACT <input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION Unclassified		
22a. NAME OF RESPONSIBLE INDIVIDUAL Ms. Ann Kerr			22b TELEPHONE (Include Area Code) (202) 697-7522		22c OFFICE SYMBOL DARPA/NMRO

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

(cont)
receive real-time data from the Regional Seismic Test Network (RSTN) stations. To meet an early DARPA deadline for these data, the antenna was installed on the roof of the Teledyne Geotech's Alexandria Laboratory.

At the completion of the installation, a major demonstration of the Center's capabilities was given to numerous U.S. and foreign visitors. Also, data and programs were accessed from Geneva by the Committee of Experts who were meeting at the Disarmament Conference.

During the final five months of the contract period, real-time data from the RSTN, Seismic Research Observatories (SRO), Global Digital Seismic Network (GDSN), World Meteorological Organization (WMO), and other sources were being routinely collected and stored in the Center's databases. *Key*

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

ABSTRACT

This report summarizes the work performed to establish a Center for Seismic Studies for the Defense Advanced Research Projects Agency (DARPA). It covers Phase I of a three-phase contract; the first phase was for the time period beginning December 1, 1981 through January 31, 1983. The objectives during this phase were to obtain a suitable facility, modify it to accommodate people, computer systems, magnetic tape storage, a film library, and to provide offices, conference rooms, a demonstration room, and technical libraries for visitors and staff. Secure areas were also needed for processing and storing classified data.

The site selected for the Center was Rosslyn, Virginia, in close proximity to the headquarters of DARPA. Most of the computer equipment came from Lincoln Laboratories. It was shipped and installed in several stages throughout the contract period. Different configurations of the systems were made to accommodate changes in communication software, new hardware, and hardware from other sources. A satellite antenna was procured to receive real-time data from the Regional Seismic Test Network (RSTN) stations. To meet an early DARPA deadline for these data, the antenna was installed on the roof of Teledyne Geotech's Alexandria Laboratory.

At the completion of the installation, a major demonstration of the Center's capabilities was given to numerous U.S. and foreign visitors. Also, data and programs were accessed from Geneva by the Committee of Experts who were meeting at the Disarmament Conference.

During the final five months of the contract period, real-time data from the RSTN, Seismic Research Observatories (SRO), Global Digital Seismic Network (GDSN), World Meteorological Organization (WMO) and other sources were being routinely collected and stored in the Center's data bases.

Accession For	
NTIS CRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

TABLE OF CONTENTS

	Page
ABSTRACT	ii
INTRODUCTION	1
FACILITIES	2
EQUIPMENT	3
DATA PROCESSING	4
CONCLUSION	5
DISTRIBUTION LIST	7

LIST OF TABLES

Table No.	Title	Page
I	RSTN Uptime in Hours 1982-1983	6

INTRODUCTION

This final report summarizes the work performed at the Center For Seismic Studies in Rosslyn, Virginia, during the period December 1, 1981 through January 31, 1983. The activities described here were accomplished under Contract MDA903-82-C-0063, and this report fulfills Data Item 0002AF of the Report Requirements in that contract.

The objectives of this contract were 1) to accomplish the establishment of a Seismic Data Center (SDC) facility in the Washington, D.C., area; 2) transfer the SDC prototype system from Lincoln Laboratories (LL), Massachusetts; and establish it in a facility in the Washington, D.C., area; 3) support development of the SDC subsystems by LL and other contractors specified by the government; 4) establish LL and Lawrence Berkeley Laboratory (LBL) personnel on-site at the SDC facility to oversee development of the SDC prototype system; 5) support testing of the SDC using a variety of data sources; and 6) plan and support SDC demonstrations, workshops, and documentation.

During the contract period we established a facility which housed the SDC prototype system from LL, we provided on-site office space to LL and LBL personnel continued development of the prototype system, we provided software and hardware support to contractors involved in the development of the SDC system, and we contributed in SDC demonstrations, workshops, and document preparation.

In Section II of this report are discussions on the acquisition of space and the building construction of the facility. Section III discusses the transfer of the SDC equipment from LL to the Center, the installation of that equipment and other computer acquisitions. Also discussed in this section are satellite antenna plans and installations. Section IV discusses the seismic data processing that was established at the Center.

FACILITIES

A five year lease for office and computer room space for the Center for Seismic Studies was obtained from Holywell, Inc., a facilities management company. The facility occupies about 10,000 square feet on the 14th floor of an office building located in Rosslyn, Virginia. The preparation of the Center began with a consulting agreement for designing and decorating the office space, lobby, libraries and computer rooms. The facilities work was done by Holywell and their contractors who constructed most of the office, lobby, and conference rooms. This work was completed sufficiently to allow occupancy by the end of March; however, facility preparations continued through April. During this time the library shelves, kitchen cabinets and sinks, lights and ceilings in the lobby and conference rooms, and the shelves and coat racks in the closets were finished. Additional conference room tables, a speaker's podium, and a porcelain markerboard were obtained. Finally, an audio/projection system was installed in the main conference room.

A sublease from our neighbor tenant, Energy Capital, for 4,000 more square feet of office space adjacent to the Center was obtained later in the contract period, as DARPA anticipated an influx of scientists and visitors.

Constructing the computer rooms required contractors other than those used by Holywell. We obtained a subcontract with Williard, Inc., who had worked with us in past computer room installations, for installing the computer room raised flooring, air conditioning, and power distribution unit. Most of the computer room construction, including overhead lighting and drop ceiling, raised floor, power distribution unit, air conditioners, and the HALON fire protection system, were complete by March, 1982. A HALON system test was performed and accepted by the Fire Marshall. A test of the 14th floor fire alarm system was also approved at the same time.

The electrical supply for the 14th floor surprisingly was inadequate for the addition of the planned computer facility, which required 45 tons of air conditioning equipment and a 100KVA power distribution unit. It was also necessary to meter the computer room power separately for billing purposes. A separate 400-ampere feed was installed from the basement power entry area to the computer room on the 14th floor.

A meeting with the National Security Agency (NSA) inspectors, DARPA, and Teledyne Geotech was held to determine what was needed to secure an area for processing classified data. It was necessary to use low-pass filters for telephones in the computer room; use metal shielding in all peripheral walls; tie a common electrical ground plate to all computers, peripherals and walls; use the common ground connected to the building ground in the basement rather than the utility power ground; and use a disconnect arrangement for any computer and peripherals connections to communication lines and any terminals outside the computer room. Curtains with a metallic thread for the computer room also were installed. The Center received its TOP SECRET facility clearance from the Defense Investigative Service (DIS) during October, 1982.

EQUIPMENT

The first computers, a Digital Equipment Company (DEC) PDP 11/44 from Lincoln Labs and a new DEC VAX 11/780, with its associated peripherals, were installed during March. A second VAX from Lincoln Labs was received and installed in April. Two Megatek display units for the Seismic Analyst Station (SAS) were installed shortly thereafter. Most of the equipment was installed without excessive problems; however the installation of one of the VAX's was hampered by malfunctions of the Systems Industries disk drives. Another 300 MB disk drive was installed to one of the VAX's to provide on-line storage of two 300 MB and two 675 MB drives.

The SAS was transferred from the PDP 11/44 to a VAX computer, and the Megatek scope for viewing and manipulating seismic waveforms was connected by its own Unibus adapter in order to lessen the impact of the SAS on the rest of the processes running on this VAX.

The PDP 11/34 computer needed for an ARPANET connection was installed. It was used until July when the Network Control Program became obsolete and the new network protocol was available for the VAX. The 4.1A version of UNIX was installed on both VAX's, and as a result, all communication with the Center using the ARPANET must use the TCP/IP protocols.

A satellite antenna and receive-only terminal for five Regional Seismic Test Network (RSTN) stations were first installed on the roof at Teledyne Geotech's Alexandria Laboratory in order to meet the timetable established by DARPA for having real-time data. Five 4800-baud data circuits were first used to transmit the data from Alexandria to Rosslyn. These data were received at Rosslyn by a Geotech-supplied Receiver Interface (RI). This device buffered the data and separated the data channels before they were sent to the Communication Interface System (CIS). Also, the RI displayed system status which could then be monitored by operations personnel. The CIS also served as a data buffer, and it formatted the data to be transmitted to a VAX using the Proteon network. Because of throughput limitations, it was necessary for the CIS also to be able to record the data on magnetic tape. The 4800 baud data circuits in Alexandria were replaced by a 20-channel multiplexor and a wide band circuit needed for both the five data streams and terminal access by the Teledyne Geotech research staff in Alexandria.

Drawings and cost quotes for mounting a satellite antenna on the roof of the Rosslyn facility were obtained from the structural engineers.

Equipment installed in November included the Terminal Interface Units for the Proteon local network, AVIV cabinets for the two Cipher tape drives, and the Tymnet multiplex system.

The last shipment of equipment, tape library and journal library arrived from Lincoln Lab in November.

A 9.6kb private phone circuit to S-Cubed at La Jolla, California, was obtained through AT&T to support their research contracts using data accumulated at the Center.

The WMO line, which carries seismic detection reports from observatories around the world, was installed in April.

DATA PROCESSING

A major demonstration for numerous visitors from the USA and several foreign countries was held in May. All elements of the Center were demonstrated, including the on-line RSTN waveform data from the satellite antenna, the INGRES database storage/retrieval system, the Seismic Analyst Station with both the waveform Megatek display and the world map color Megatek display, and research use of the Remote Seismic Terminal (RST).

A video tape was produced to show the Center, the SAS capabilities, and the value of digital waveform data in bulletin preparation. The film, with both an English and a Soviet sound track, was shown at the Center and at the disarmament negotiations in Geneva.

The use of the RST was also demonstrated in Geneva for the Committee of Experts, Conference on Disarmament. The Norwegian participants were able to dial up the VAX at the Center and display the waveform data.

An operational test to generate an earthquake bulletin from the RSTN waveform data received by the satellite antenna and the alphanumeric data received over the WMO circuit revealed that the program COLLECT, which transfers waveform data from the CIS to the INGRES database, was too slow. A faster version was prepared at Lawrence Berkeley Laboratories; meanwhile, the data were transferred from the CIS system to the VAX database using magnetic tapes.

During October 68 tapes were recorded in the System Control and Receiving Station (SCARS) format on the CIS, and these plus 55 GDSN day tapes were entered into the tape library and the INGRES database. In November, 36 tapes were recorded in the SCARS format on the CIS. A brief summary of data obtained and processed is given in the attached table.

CONCLUSION

All of the objectives for Phase I of the contract period were met. To meet these objectives, it was necessary to:

- establish the facility,
- ship and install equipment from Lincoln Laboratories in Boston, Massachusetts and Alexandria Laboratories,
- move technical libraries from Lincoln Laboratories, and
- work and coordinate with numerous contractors and agencies: Lincoln Laboratories, Lawrence Berkeley Laboratories, S-CUBED, Teledyne Geotech, Sandia National Laboratories, Williard, Inc., Holywell Inc., DARPA, USGS, Motorola, NSA, and the Arlington Fire Department.

This effort resulted in routine operation for:

- real-time data acquisition and storage,
- cataloging and storing data in data bases,
- maintaining computers and their peripherals, and
- operating the VAX and the PDP systems.

TABLE I
RSTN UPTIME IN HOURS
1982-1983

	SEP	OCT	NOV	DEC	JAN
RSCP	499.2	305	N/A	290.3	679.9
RSNT	255.9	526	237.5	316.5	679.9
RSNY	535.5	520	237.5	316.4	670.2
RSON	N/A	224	237.5	314.9	680.2
RSSD	544.5	526	237.5	295.7	669.6
MAX HRS.	720	744	720	744	744
# OF TAPES	55	65	36	49	107

RSTN DETECTIONS
1982-1983

	SEP	OCT	NOV	DEC	JAN
RSCP	5637	2858	N/A	2175	4156
RSNT	564	1341	531	2439	3275
RSNY	4251	2311	1016	1781	1957
RSON	N/A	778	896	2550	2845
RSSD	4481	3559	1693	2266	3254

OUTSIDE ARRIVALS
1982-1983

	SEP	OCT	NOV	DEC	JAN
CANADA	1318	1023	1255	1261	2573
NEIS	10925	13516	15742	14642	11459
UK	N/A	2060	1726	1444	4662
WMO	4727	3979	3660	4444	5924
YKA	105	65	170	670	1097

DISTRIBUTION LIST

RECIPIENT	NO. OF COPIES
Director Defense Advanced Research Projects Agency Attn: TIO/Admin 1400 Wilson Boulevard Arlington, VA 22209	3
Defense Documentation Center Cameron Station Alexandria, VA 22314	12